

## WHAT IS CLAIMED IS:

1. A device for detecting a presence of an analyte in a sample comprising a device body configured with at least one reaction chamber configured for containing a sensor capable of producing a detectable signal when exposed to the analyte in the sample, said at least one reaction chamber being in fluid communication with at least one sample port and at least one actuator port via a first set of microfluidic channels arranged such that application of a negative pressure to said at least one actuator port delivers fluid placed in said at least one sample port to said at least one reaction chamber.
2. The device of claim 1, wherein said at least one reaction chamber is configured so as to enable sustaining a negative pressure environment within said at least one reaction chamber.
3. The device of claim 1, wherein said at least one reaction chamber is configured such that said material placed therein does not substantially obstruct fluid flow in and out of said at least one reaction chamber.
4. The device of claim 1, wherein said microfluidic channels of said first set of microfluidic channels are connected to said at least one reaction chamber substantially above a bottom surface thereof.
5. The device of claim 1, wherein said at least one reaction chamber includes a plurality of reaction chambers sequentially interconnected via a second set of fluidic microchannels.
6. The device of claim 1, wherein said detectable signal is selected from the group consisting of a detectable optical signal, a detectable electrical signal and a detectable electrochemical signal.
7. The device of claim 1, further comprising a pumping device for generating said negative pressure.

8. The device of claim 7, wherein said pumping device comprises a plurality of micro-pumps.

9. The device of claim 8, further comprising an electronic circuitry designed and constructed for controlling said plurality of micro-pumps.

10. The device of claim 9, wherein said electronic circuitry comprises at least one feedback line for monitoring operation and/or status of said plurality of micro-pumps.

11. The device of claim 1, further comprising a sample reservoir being in fluid communication with said sample port.

12. The device of claim 1, wherein said device body is capable of allowing transmission of light having a predetermined wavelength therethrough.

13. The device of claim 12, wherein said device body comprises a material selected from the group consisting of silicon, plastic and glass.

14. The device of claim 1, further comprising at least one humidity sensor, adapted for being positioned in said at least one reaction chamber, said humidity sensor being capable of generating a detectable signal when a level of humidity in said at least one reaction chamber is above a predetermined threshold.

15. The device of claim 1, wherein said plurality of chambers are addressable, hence allow imaging thereof.

16. The device of claim 15, wherein at least a portion of said plurality of chambers comprises different sensors, each capable of generating a detectable signal when exposed to a different analyte of the at least one analyte.

17. The device of claim 1, wherein at least a portion of said sensors are biological sensors.

18. The device of claim 17, wherein at least a portion of said biological sensors are capable of generating said detectable signal by producing fluorescent materials.

19. The device of claim 17, wherein at least a portion of said biological sensors are capable of generating said detectable signal by producing bioluminescent materials.

20. The device of claim 17, wherein at least a portion of said biological sensors are capable of generating said detectable signal by producing phosphorescent materials.

21. The device of claim 17, wherein said biological sensors comprises a population of cells, said population of cells including a reporter expression construct being expressible in a cell of said population when exposed to the analyte.

22. The device of claim 21, wherein said population of cells is eukaryotic cells. \_\_\_\_\_

23. The device of claim 21, wherein said population of cells is prokaryotic cells.

24. The device of claim 21, wherein each of said reporter expression construct includes a cis-acting regulatory element being operably fused to a reporter gene.

25. The device of claim 21, wherein said reporter gene is selected from a group consisting of a fluorescent protein, an enzyme and an affinity tag.

26. The device of claim 24, wherein said cis-acting regulatory element is a promoter.

27. The device of claim 26, wherein said promoter is selected from the group consisting of *MipA*, *LacZ*, *GrpE*, *Fiu*, *MalPQ*, *oraA*, *nhoA*, *recA*, *otsAB* and *yciD*.

28. The device of claim 24, wherein said cis-acting regulatory element is stress regulated.

29. The device of claim 21, wherein the analyte is selected from the group consisting of a condition and a substance.

30. The device of claim 29, wherein said condition is selected from the group consisting of a temperature condition and a radiation condition.

31. The device of claim 29, wherein said substance is a naturally occurring product or a synthetic product.

32. The device of claim 21, wherein said populations of cells is tagged.

33. A system for detecting at least one analyte present in a sample, the system comprising:

a detecting device having a plurality of reaction chambers and a plurality of channels interconnecting at least a portion of said plurality of reaction chambers, wherein at least a portion of said plurality of reaction chambers comprises a sensor, capable of generating a detectable optical signal when exposed to the at least one analyte;

a planar light detector capable of receiving optical signals from said detecting device and providing an image of sensors generating said optical signals.

34. The system of claim 33, further comprising a data processor, supplemented by an algorithm for receiving image information from said planar light detector and determining presence of the at least one analyte.

35. The system of claim 33, further comprising a control unit for sending control signals to said detecting device.

36. The system of claim 33, further comprising a temperature control unit for controlling a temperature of said detecting device and/or said planar light detector.

37. The system of claim 36, wherein said temperature control unit is selected from the group consisting of a thermoelectric device, a liquid cooler, a gas cooler and a blower.

38. The system of claim 34, wherein said algorithm is capable of determining concentration of the at least one analyte.

39. The system of claim 33, wherein said detecting device is disposable.

40. The system of claim 33, wherein said plurality of reaction chambers are configured so as to enable sustaining a negative pressure environment within said plurality of reaction chambers.

41. The system of claim 33, wherein said plurality of reaction chambers are configured such that said sensor does not substantially obstruct fluid flow in and out of said plurality of reaction chambers.

42. The system of claim 33, wherein said plurality of channels are connected to said plurality of reaction chamber substantially above a bottom surface thereof.

43. The system of claim 33, wherein at least a portion of said plurality of reaction chambers are sequentially interconnected via at least a portion of said channels.

44. The system of claim 33, wherein a body of said detecting device is capable of allowing transmission of light having a predetermined wavelength therethrough.

45. The system of claim 44, wherein said body comprises a material selected from the group consisting of silicon, plastic and glass.

46. The system of claim 33, wherein said sensor is a biological sensor.

47. The system of claim 33, wherein said biological sensors is capable of producing a bioluminescent material.

48. The system of claim 33, wherein said biological sensors is capable of producing a phosphorescent material.

49. The system of claim 33, wherein said biological sensor is capable producing a fluorescent material.

50. The system of claim 33, wherein said planar light detector comprises a matrix having a plurality of addressable elementary units, each being capable of converting said optical signal into an electrical signal.

51. The system of claim 50, wherein said elementary units of said planar light detector are selected from the group consisting of positive-intrinsic-negative photodiodes, avalanche photodiodes, silicon chips and photomultipliers.

52. The system of claim 33, wherein said planar light detector is selected from the group consisting of a CCD camera and a CMOS detector.

53. The system of claim 33, further comprising a light source for emitting excitation light so as to excite said sensor to thereby emit said optical signal.

54. The system of claim 53, wherein said light source comprises a light emitting diode.

55. The system of claim 54, wherein said light emitting diode is coupled to a collimator capable of redirecting said excitation light to form a substantially collimated light beam.

56. The system of claim 53, wherein said light source comprises an arrangement of light emitting diodes.

57. The system of claim 54, wherein each light emitting diode of said arrangement of light emitting diodes is coupled to a collimator capable of redirecting said excitation light to form a substantially collimated light beam.

58. The system of claim 53, further comprising a temperature control unit for controlling a temperature of said detecting device, said planar light detector and/or said light source.

59. The system of claim 58, wherein said temperature control unit is selected from the group consisting of a thermoelectric device, a liquid cooler, a gas cooler and a blower.

60. The system of claim 53, further comprising at least one selective filter positioned between said detecting device and said planar light detector, said at least one selective filter being capable of transmitting said optical signals and preventing transmission of said excitation light.

61. The system of claim 53, further comprising a plurality of optical fibers for guiding said excitation light into said detecting device.

62. The system of claim 33, further comprising an optical focusing device for focusing said optical signal on said planar light detector.

63. The system of claim 62, wherein said optical focusing device is a video lens.

64. The system of claim 62, wherein said optical focusing device comprises a plurality of lenses positioned to substantially prevent cross talks between different optical signals of different sensors.

65. The system of claim 62, further comprising at least one opaque object, positioned between said detecting device and said planar light detector, wherein said optical focusing device is configured to focus said excitation light on said at least one opaque object thereby to substantially prevent impingement of said excitation light on said planar light detector.

66. The system of claim 62, further comprising at least one reflector, positioned between said detecting device and said planar light detector, wherein said optical focusing device is configured to focus said excitation light on said at least one reflector so that said excitation light is reflected back to at least one of said plurality of reaction chambers.

67. The system of claim 33, further comprising a transport mechanism for actuating transport of a sample fluid in said plurality of fluid channels, thereby to fill said plurality of reaction chambers with said sample fluid.

68. The system of claim 67, further comprising a draining system and further wherein said transport mechanism is capable of maintaining a continues flow of said sample fluid in said plurality of fluid channels thereby to continuously replace said sample fluid in said plurality of reaction chambers.

69. The system of claim 68, wherein said planar light detector is capable of providing said image substantially in real time.



70. The system of claim 69, wherein a portion of said plurality of reaction chambers comprises a material capable of generating a detectable reference optical signal at all times.

71. The system of claim 67, wherein said transport mechanism comprises a pumping device, capable of generating a negative pressure in said plurality of reaction chambers and said plurality of fluid channels.

72. The system of claim 71, wherein said pumping device comprises a plurality of micro-pumps.

73. The system of claim 72, further comprising an electronic circuitry designed and constructed for controlling said plurality of micro-pumps.

74. The system of claim 73, wherein said electronic circuitry comprises at least one feedback line for monitoring operation and/or status of said plurality of micro-pumps.

75. The system of claim 71, wherein said transport mechanism further comprises a vacuum chamber connected to said pumping device and capable of maintaining a negative pressure environment.

76. The system of claim 75, wherein said transport mechanism further comprises a pressure sensor for sensing a pressure at an inlet of said vacuum chamber.

77. The system of claim 75, wherein said transport mechanism further comprises a flow sensor for sensing flow parameters of said sample fluid.

78. The system of claim 77, wherein said transport mechanism further comprises at least one tap for controlling said flow parameters.

79. The system of claim 71, wherein said transport mechanism further comprises at least one valve for activating and deactivating said transport of said sample fluid.

80. The system of claim 71, wherein said transport mechanism further comprises a hydrophobic filter for protecting at least one component of said transport mechanism.

81. The system of claim 67, further comprising electronic circuitry for controlling flow rate of said sample fluid.

82. The system of claim 81, wherein said electronic circuitry is designed and constructed to allow equal filling of said sample fluid in said plurality of reaction chambers.

83. The system of claim 67, wherein said transport mechanism comprises an electric field generator, for generating a non-uniform electric field capable of inducing polarization on molecules of said sample fluid, hence to fill said plurality of reaction chambers with said sample fluid via dielectrophoresis.

84. The system of claim 67, wherein said transport mechanism comprises a column of said sample fluid, said column having a height selected such that a hydrostatic pressure, generated at a bottom of said column, is sufficient for actuating said transport of said sample fluid.

85. The system of claim 33, wherein said plurality of fluid channels are designed and constructed such that fluid sample flows therethrough via capillary forces.

86. The system of claim 33, wherein said sample is a liquid sample.

87. The system of claim 33, wherein said sample is a gas sample.

88. The system of claim 87, further comprising a mechanism for binding components of said gas sample to an aqueous phase.

89. The system of claim 46, wherein said biological sensors comprises a population of cells, said population of cells including a reporter expression construct being expressible in a cell of said population when exposed to the analyte.

90. The system of claim 89, wherein said population of cells is eukaryotic cells.

91. The system of claim 89, wherein said population of cells is prokaryotic cells.

92. The system of claim 89, wherein each of said reporter expression construct includes a cis-acting regulatory element being operably fused to a reporter gene.

93. The system of claim 89, wherein said reporter gene is selected from a group consisting of a fluorescent protein, an enzyme and an affinity tag.

94. The system of claim 92, wherein said cis-acting regulatory element is a promoter.

95. The system of claim 94, wherein said promoter is selected from the group consisting of *MipA*, *LacZ*, *GrpE*, *Fiu*, *MalPQ*, *oraA*, *nhoA*, *recA*, *otsAB* and *yciD*.

96. The system of claim 92, wherein said cis-acting regulatory element is stress regulated.

97. The system of claim 89, wherein the analyte is selected from the group consisting of a condition and a substance.

98. The system of claim 97, wherein said condition is selected from the group consisting of a temperature condition and a radiation condition.

99. The system of claim 97, wherein said substance is a naturally occurring product or a synthetic product.

100. The system of claim 89, wherein said populations of cells is tagged.

101. A device for detecting at least one analyte present in a sample, the device comprising at least one array of reaction chambers, each array having a plurality of reaction chambers, sequentially interconnected by a plurality of fluid channels, in a manner such that each reaction chamber is in direct fluid communication with at least two other reaction chambers, whereby a first reaction chamber of said at least two other reaction chambers serves as a fluid source and a second reaction chamber of said at least two other reaction chambers serves as a fluid sink, wherein each reaction chamber is designed for containing a sensor capable of generating a detectable signal when exposed to the at least one analyte.

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102. The device of claim 101, wherein said fluid channels are microfluidic channels.

103. The device of claim 101, further comprising a pump interface connectable to a pumping device.

104. The device of claim 103, further comprising said pumping device.

105. The device of claim 104, wherein said pumping device comprises a plurality of micro-pumps.

106. The device of claim 105, further comprising an electronic circuitry designed and constructed for controlling said plurality of micro-pumps.

107. The device of claim 106, wherein said electronic circuitry comprises at least one feedback line for monitoring operation and/or status of said plurality of micro-pumps.

108. The device of claim 101, wherein said plurality of reaction chambers are configured so as to enable sustaining a negative pressure environment within said plurality of reaction chambers.

109. The device of claim 101, wherein said plurality of reaction chambers are configured such that said sensor does not substantially obstruct fluid flow in and out of said plurality of reaction chambers.

110. The device of claim 101, wherein said plurality of fluid channels are connected to said plurality of reaction chamber substantially above a bottom surface thereof.

111. The device of claim 101, wherein a body of the device is capable of allowing transmission of light having a predetermined wavelength therethrough.

112. The device of claim 111, wherein said body comprises a material selected from the group consisting of silicon, plastic and glass.

113. The device of claim 101, wherein at least a portion of said sensors are biological sensors.

114. The device of claim 113, wherein at least a portion of said biological sensors are capable of generating said detectable signal by producing fluorescent materials.

115. The device of claim 113, wherein at least a portion of said biological sensors are capable of generating said detectable signal by producing bioluminescent materials.

116. The device of claim 113, wherein at least a portion of said biological ~~sensors are capable of generating said detectable signal by producing phosphorescent materials.~~

117. The device of claim 113, wherein said biological sensors comprises a population of cells, said population of cells including a reporter expression construct being expressible in a cell of said population when exposed to the analyte.

118. The device of claim 117, wherein said population of cells is eukaryotic cells.

119. The device of claim 117, wherein said population of cells is prokaryotic cells.

120. The device of claim 117, wherein each of said reporter expression construct includes a cis-acting regulatory element being operably fused to a reporter gene.

121. The device of claim 117, wherein said reporter gene is selected from a group consisting of a fluorescent protein, an enzyme and an affinity tag.

122. The device of claim 120, wherein said cis-acting regulatory element is a promoter.

123. The device of claim 122, wherein said promoter is selected from the group consisting of *MipA*, *LacZ*, *GrpE*, *Fiu*, *MalPQ*, *oraA*, *nhoA*, *recA*, *otsAB* and *yciD*.

124. The device of claim 120, wherein said cis-acting regulatory element is stress regulated.

125. The device of claim 117, wherein the analyte is selected from the group consisting of a condition and a substance.

126. The device of claim 125, wherein said condition is selected from the group consisting of a temperature condition and a radiation condition.

127. The device of claim 125, wherein said substance is a naturally occurring product or a synthetic product.

128. The device of claim 117, wherein said populations of cells is tagged.

129. A device for detecting at least one analyte present in a sample, the device comprising a substrate configured with:

(a) a plurality of chambers for holding a fluorescent sensor and incubating reaction between said fluorescent sensor and the at least one analyte;

(b) a plurality of fluid channels interconnecting at least a portion of said plurality of chambers; and

(c) a plurality of waveguides designed and constructed to distribute excitation light among said plurality of chambers in a manner such that impingement of said excitation light on said fluorescent sensor is maximized and impingement of said excitation light on a surface of said substrate is minimized.

130. The device of claim 129, wherein said substrate is made of a disposable material.

131. The device of claim 129, wherein said plurality of waveguides are integrated with or formed in said substrate.

132. The device of claim 129, wherein said substrate is formed with a plurality of grooves, sizewise compatible with said plurality of waveguides, and further wherein at least a portion said plurality waveguides are designed insertable to and/or detachable of at least a portion of said plurality of grooves.

133. The device of claim 129, wherein said plurality of waveguides are arranged in a multi-furcated arrangement.

134. The device of claim 133, wherein said multi-furcated arrangement ~~comprises a plurality of light-splitting junctions, each capable of~~ redirecting said excitation light into at least one of said plurality of waveguides.

135. The device of claim 129, wherein said plurality of waveguides are capable of imposing at least one predetermined propagation direction on said excitation light.

136. The device of claim 135, wherein said at least one predetermined propagation direction is substantially parallel to said surface of said substrate.

137. The device of claim 129, further comprising at least one additional optical element, capable of imposing at least one predetermined propagation direction on said excitation light.

138. The device of claim 137, wherein said at least one predetermined propagation direction is substantially parallel to said surface of said substrate.

139. The device of claim 137, wherein said at least one additional optical element is selected from the group consisting of a diffraction grating, a reflection grating and a mini-prism.

140. The device of claim 129, wherein at least one of said plurality of chambers comprises a reflective coat, covering at least one internal wall of said chamber.

141. The device of claim 129, wherein said reflective coat is wavelength selective.

142. The device of claim 129, further comprising a selective filter positioned on or close to said substrate and capable of prevention transmission of said excitation light therethrough.



143. The device of claim 129, further comprising a plurality of optical ~~focusing devices positioned so as to focus or collimate~~ optical signals generated by said florescent sensor in response to said excitation light.

144. The device of claim 143, wherein said plurality of optical focusing devices are selected from the group consisting of microlenses and diffraction gratings.

145. The device of claim 129, wherein said fluid channels are microfluidic channels.

146. The device of claim 129, further comprising a pump interface connectable to a pumping device.

147. The device of claim 146, further comprising said pumping device.

148. The device of claim 147, wherein said pumping device comprises a plurality of micro-pumps.

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149. The device of claim 148, further comprising an electronic circuitry designed and constructed for controlling said plurality of micro-pumps.

150. The device of claim 149, wherein said electronic circuitry comprises at least one feedback line for monitoring operation and/or status of said plurality of micro-pumps.

151. The device of claim 129, wherein said plurality of reaction chambers are configured so as to enable sustaining a negative pressure environment within said plurality of reaction chambers.

152. The device of claim 129, wherein said plurality of reaction chambers are configured such that said sensor does not substantially obstruct fluid flow in and out of said plurality of reaction chambers.

153. The device of claim 129, wherein said plurality of fluid channels are ~~connected to said plurality of reaction chamber substantially above a bottom surface thereof.~~

154. The device of claim 129, wherein a body of the device is capable of allowing transmission of light having a predetermined wavelength therethrough.

155. The device of claim 154, wherein said body comprises a material selected from the group consisting of silicon, plastic and glass.

156. An apparatus for imaging a pattern of optical signals received from a fluorescent material arranged in a plurality of predetermined locations, the apparatus comprising:

- (a) a planar light detector engaging a first plane;
- (b) an optical element engaging a second plane substantially parallel to said first plane;
- (c) a light source interposed between said first and said second planes, said light source capable of generating excitation light in a direction other than a direction of said planar light detector;

said optical element and said planar light detector being designed and constructed such that said excitation light is collimated by said optical element and impinges on at least a portion of said plurality of predetermined locations, and emission light, emitted by said fluorescent material in response to said excitation light, is focused by said optical element and impinges on said planar light detector, to form the pattern of the optical signal thereupon.

157. The apparatus of claim 156, wherein said optical element comprises a plurality of lenses.

158. The apparatus of claim 157, wherein an arrangement of said plurality of lenses is compatible with an arrangement of the plurality of predetermined locations.

159. The apparatus of claim 156, wherein said light source comprises a plurality of light emitting devices.

160. The apparatus of claim 159, wherein an arrangement of said plurality of lenses is compatible with an arrangement of the plurality of predetermined locations.

161. The apparatus of claim 160, wherein an arrangement of said plurality of light emitting devices is compatible with said arrangement of said plurality of lenses.

162. The apparatus of claim 156, further comprising an infrared filter positioned between said planar light detector and said light source.

163. The apparatus of claim 156, further comprising an additional optical element positioned between said light source and said planar light detector, said additional optical being capable of preventing said excitation light from impinging on said planar light detector.

164. The apparatus of claim 163, wherein said additional optical element comprises at least one opaque object.

165. The apparatus of claim 163, wherein said additional optical element comprises at least one reflector.

166. The apparatus of claim 165, wherein a shape of said reflector is selected so as to direct said excitation light in a direction of said optical element engaging said first plane.

167. The apparatus of claim 161, wherein each of said plurality of light emitting devices is positioned at a focal point of one lens of said plurality of lenses.

168. A method of determining concentration of an analyte from optical signals recorded of a reaction chamber in response to excitation light, the reaction

chamber containing a plurality of biological sensors producing a fluorescent material when exposed to the analyte, the method comprising:

- (a) defining a plurality of slices, each slice having at least one biological reporter;
- (b) for each slice, representing said at least one biological reporter as at least one equivalent light emitter, located at a predetermined location within said slice, and calculating local radiation contribution emitted by said at least one equivalent light emitter; and
- (c) integrating said local radiation contribution over said plurality of slices so as to obtain an integrated radiation intensity; and
- (d) using the recorded optical signals and said integrated radiation intensity for determining the concentration of the analyte.

169. The method of claim 168, wherein said calculating said local radiation contribution comprises calculating effective quantum efficiency and at least one transmission coefficient corresponding to the excitation light and light emitted by said at least one equivalent light emitter.

170. The method of claim 169, wherein said effective quantum efficiency comprises emission effective quantum efficiency and excitation effective quantum efficiency.

171. The method of claim 168, wherein said determining the concentration of the analyte is by calculating an occupation area of the fluorescent material, said occupation area being defined as a projection of an occupation volume on a plane perpendicular to a direction of the excitation light.

172. A device for detecting at least one analyte present in a sample, the device comprising a plurality of reaction chambers and a plurality of channels, interconnecting at least a portion of said plurality of reaction chambers, wherein each one of said plurality of reaction chambers comprises a biological sensor, capable of generating a detectable signal when exposed to the at least one analyte.

173. The device of claim 172, wherein said plurality of chambers are addressable, hence allow imaging thereof.

174. The device of claim 173, wherein at least a portion of said plurality of chambers comprises different biological sensors, each capable of generating a detectable signal when exposed to a different analyte of the at least one analyte.

175. The device of claim 172, wherein said detectable signal is selected from the group consisting of a detectable optical signal, a detectable electrical signal and a detectable electrochemical signal.

176. The device of claim 172, wherein at least a portion of said biological sensors are capable of generating said detectable signal by producing fluorescent materials.

177. The device of claim 172, wherein at least a portion of said biological sensors are capable of generating said detectable signal by producing bioluminescent materials.

178. The device of claim 172, wherein at least a portion of said biological sensors are capable of generating said detectable signal by producing phosphorescent materials.

179. The device of claim 172, wherein said plurality of reaction chambers are configured so as to enable sustaining a negative pressure environment within said plurality of reaction chambers.

180. The device of claim 172, wherein said plurality of reaction chambers are configured such that said biological sensor does not substantially obstruct fluid flow in and out of said plurality of reaction chambers.

181. The device of claim 172, wherein said plurality of channels are connected to said plurality of reaction chamber substantially above a bottom surface thereof.

182. The device of claim 172, wherein at least a portion of said plurality of reaction chambers are sequentially interconnected via at least a portion of said channels.

183. The device of claim 172, wherein a body of the device is capable of allowing transmission of light having a predetermined wavelength therethrough.

184. The device of claim 183, wherein said body comprises a material selected from the group consisting of silicon, plastic and glass.

185. The device of claim 172, wherein at least a portion of said biological sensors are capable of generating said detectable signal by producing fluorescent materials.

186. The device of claim 172, wherein at least a portion of said biological sensors are capable of generating said detectable signal by producing bioluminescent materials.

187. The device of claim 172, wherein at least a portion of said biological sensors are capable of generating said detectable signal by producing phosphorescent materials.

188. The device of claim 172, wherein said biological sensors comprises a population of cells, said population of cells including a reporter expression construct being expressible in a cell of said population when exposed to the analyte.

189. The device of claim 188, wherein said population of cells is eukaryotic cells.

190. The device of claim 188, wherein said population of cells is prokaryotic cells.

191. The device of claim 188, wherein each of said reporter expression construct includes a cis-acting regulatory element being operably fused to a reporter gene.

192. The device of claim 188, wherein said reporter gene is selected from a group consisting of a fluorescent protein, an enzyme and an affinity tag.

193. The device of claim 191, wherein said cis-acting regulatory element is a promoter.

194. The device of claim 193, wherein said promoter is selected from the group consisting of *MipA*, *LacZ*, *GrpE*, *Fiu*, *MalPQ*, *oraA*, *nhoA*, *recA*, *otsAB* and *yciD*.

195. The device of claim 191, wherein said cis-acting regulatory element is stress regulated.

196. The device of claim 188, wherein the analyte is selected from the group consisting of a condition and a substance.

197. The device of claim 196, wherein said condition is selected from the group consisting of a temperature condition and a radiation condition.

198. The device of claim 196, wherein said substance is a naturally occurring product or a synthetic product.

199. The device of claim 188, wherein said populations of cells is tagged.

200. A method of detecting analytes in a sample fluid, comprising:

- (a) providing a device having a plurality of reaction chambers and a plurality of channels, interconnecting at least a portion of said plurality of reaction chambers, wherein each one of said plurality of reaction chambers comprises a biological sensor, capable of generating a detectable signal when exposed to the at least one analyte;
- (b) filling at least a first portion of said plurality of reaction chambers with the sample fluid;
- (c) generating a condition for said biological sensor to generate said detectable signal; and
- (d) detecting said detectable signal thereby detecting the analytes in the sample fluid.

201. The method of claim 200, wherein said step (b) is by generating a negative pressure.

202. The method of claim 200, wherein said step (b) is by dielectrophoresis.

203. The method of claim 200, wherein said step (b) is by capillary transport.

204. The method of claim 200, wherein said step (b) is by injection.

205. The method of claim 200, wherein said detectable signal is selected from the group consisting of a detectable optical signal, a detectable electrical signal and a detectable electrochemical signal.

206. The method of claim 200, wherein said biological sensors is capable of producing a bioluminescent material.

207. The method of claim 200, wherein said biological sensors is capable of producing a phosphorescent material.



208. The method of claim 200, wherein said biological sensor is capable producing a fluorescent material.

209. The method of claim 206, wherein said step (c) comprises irradiating said biological sensor by excitation light.

210. The method of claim 210, further comprising filling different portions of said plurality of reaction chambers with different fluids.

211. The method of claim 200, wherein at least one of said different fluids has a known composition, hence serving as a control fluid.

212. The method of claim 210, wherein different portions of said plurality of reaction chambers comprise different biological sensors.

213. The method of claim 212, further comprising exposing each one of said biological sensors to at least two of said different fluids.

214. The method of claim 200, further comprising generating an image of said reaction chambers.

215. The method of claim 200, further comprising controlling a temperature of said detecting device.

216. The method of claim 215, wherein said controlling said temperature is by a thermoelectric device.

217. The method of claim 215, wherein said controlling said temperature is by a liquid cooler.

218. The method of claim 215, wherein said controlling said temperature is by a blower.

219. The method of claim 200, further comprising using said detectable signal for determining a concentration of the analyte.

220. The method of claim 200, wherein said detecting device is disposable.

221. The method of claim 205, wherein said step (d) is by a matrix having a plurality of addressable elementary units, each being capable of converting said optical signal into an electrical signal.

222. The method of claim 209, wherein said irradiation is by a light emitting diode.

223. The method of claim 209, further comprising redirecting said excitation light to form a substantially collimated light beam.

224. The method of claim 209, wherein said irradiation is by an arrangement of light emitting diodes.

225. The method of claim 209, further comprising a plurality of optical fibers for guiding said excitation light into said detecting device.

226. The method of claim 209, further comprising focusing said optical signal prior to said step (d).

227. The method of claim 226, wherein said focusing said optical signal is by a video lens.

228. The method of claim 226, wherein said optical focusing device comprises a plurality of lenses positioned to substantially prevent cross talks between different optical signals of different sensors.

229. The method of claim 200, further comprising maintaining a continuous flow of the sample fluid in said plurality of fluid channels thereby to continuously replace the sample fluid in said plurality of reaction chambers.

230. The method of claim 229, further comprising providing an image of said plurality of reaction chambers substantially in real time.

231. The method of claim 230, wherein a portion of said plurality of reaction chambers comprises a biological material capable of generating a detectable reference optical signal at all times.

232. The method of claim 200, wherein the fluid is liquid.

233. The method of claim 200, wherein the fluid is gas.

234. The method of claim 233, further comprising binding components of said gas to an aqueous phase.

235. A method of dehydrating a biological material, the method comprising:  
providing a first set of chambers for holding the biological material, and a second set of chambers having at least one fluid channel formed therein;  
placing said first set of chambers and said second set of chambers in a negative pressure environment so as to dehydrate the biological material; and  
positioning said second set of chambers on said first set of chambers so as to seal said first set of chambers hence to maintain said negative pressure in said first and said second sets of chambers.

236. The method of claim 235, wherein each of said second set of chambers comprises a window for allowing evaporation of liquids therethrough.

237. The method of claim 236, further comprising pressing said second set of chambers on said first set of chambers, such that when a respective chamber of said

second set of chambers is pressed on a respective chamber of said first set of chambers  
~~a respective window is sealed.~~

238. The method of claim 237, wherein said pressing is done so as not to obstruct said at least one fluid channel.

239. The method of claim 235, further comprising immobilizing said biological material to each of said first set of chambers, prior to said step of placing said first and said second sets of chambers in said negative pressure environment.

240. The method of claim 239, wherein said immobilizing is by encapsulating said biological sensor into a meltable membrane.

241. The method of claim 239, wherein said immobilizing is by encapsulating said biological material into a meltable membrane.

242. The method of claim 239, wherein said immobilizing is by a material selected from the group consisting of agar, alginate, poly-vinyl alcohol, sol-gel and carraginan.

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